

Minimoog Modwheel bleedthru explained:

Modulation bleedthru via the modwheel is a common problem on all rev Minimoogs.

It is unique and inherent to the design of the Mini.

Instead of how signals are normally imparted, that being through a potentiometer and picked up by the pot's wiper, the Mini's modwheel implements a different approach.

The modulation is actually constantly on fully and the pot instead shorts it out (to ground.)

This unique design thus requires a pot to have a low "end resistance" when the wheel is fully down.

If the pot doesn't reach 1 ohm or less when fully down, noticeable modulation such as vibrato can remain.

The only way to fully remove it then, would be to turn off the front panel switch(es) for a modulation destination, either OSCs or VCF.

For obvious reasons, this scenario is often undesirable.

It's a reasonable expectation to have zero vibrato on a sound when the modwheel is fully down, yet many Minis won't achieve this.

Later Minis, S/N10175 and up have a gold-plated Cinch-Jones connector to the modwheels and feature a mod pot with a specially silvered "landing zone" for maximum contact when the wheel is down.

The better plating and improved pot allows the lowest possible resistance (ohms) when the wheel is down.

These Minis usually achieve the lowest modulation bleedthru of all models, but can still fail given age and wear. Even later Minis can exhibit pronounced modwheel bleedthru.

The immediate thought would be to mod the Mini so the modulation is delivered in the standard way potentiometers are usually wired.

That being the signal coming in on one side of the pot, the other side being grounded and the wiper then sweeping from full modulation to full ground.

However, this idea won't work with the stock pot and presents a problem for other pots as well.

You see, the reason Moog likely implemented such a backwards approach to what would normally be a simple and common usage for a pot comes into meaning when one considers the taper of the pot.

That is, how deep the modulation is delivered for how far the wheel travels.

Remember, a modwheel doesn't go all the way around.

The travel is limited by metal stops on the wheel itself.

So without fully being able to turn the wheel around, one would either never fully turn on the modulation or fully turn it off.

So the actual reason for all this nonsense of such a strange circuit is for musical playability.

A player wants the ability to add modulation, normally OSC vibrato signals, in a nuanced fashion.

If the pot taper was linear, ie: 50% for 50% travel, vibrato would come on too strong with just a small movement of the wheel and go on to full non-musical science-fiction sounds long before running out of wheel travel.

Like a guitar, one doesn't want to impart octaves of vibrato range.

They only want a few semitones at most and usually much, much less.

But unlike a guitar, one does want some heavy modulation once the wheel is farther up.

The best musical playability is therefore to use a design as Moog did with an exponentially tapered pot, not linear and one wired in: backwards.

Only with this tapered pot and this strange configuration of grounding it out (instead of dialing it in) does one achieve the best impartation of musical vibrato.

Ok, so what do you do when YOUR pot is causing bleedthru?
Well first, make sure it's the pot causing it.

This is easily achieved by shorting across the only pot terminals wired up.
It's preferable to use something like a screwdriver or pliers and not a jumper wire as jumpers tend to add some ohms themselves due to wire resistance.

If this test above eliminates or greatly improves elimination of vibrato, the problem is the pot itself.
If not, other reasons can be corroded mod section connector pins, poor connections on an edge card inside the Moog or even possible failure of a circuit known as the "modulation amp."

But let's not get ahead of ourselves.
Usually it's the pot.
Try the "shorting" test above to make sure first.

Ok, so your pot is bad. (no jokes please. ;)
What do you do?

Finding a 1 meg audio (exponential) taper pot is not as easy as you might think once this "end resistance of 1ohm or less" requirement is necessary.
Many pots won't even come close.
Some pots, brand new ones of decent quality too, usually only achieve 2-25 ohms (or more) when their pot is fully up.

That's right- when the wheel is fully down, the pot is fully up.
It's mounted upside-down.

There are also various different exponential tapers of pots.
Linear is linear, but not all audio (exponential) pots are the same.

This means you may have a very difficult time finding a replacement, even new.
We've only found them once or twice over 25 years of trying, buying and failing.

Again, what to do?

Generally I would try to improve things with what I had.
That is, open the pot and clean it.
This alone can help a great deal, but can be difficult to do well.
It's possible to damage the pot and then have no replacement waiting.
It's also possible to open, but not close as well as it was before and the case, the part which one opens and closes is also the part with the "stop" for travel.
So if you can't get the case back on in the right position and tightly, you can actually make the situation worse.

Despite these pots being sealed, sometimes it's possible to spray them from outside.
It's a hit or miss gamble, but also brings into great question what to spray and here too one is limited.
I intensely loathe Caig products like Deoxit for several reasons, but here is not the place to discuss them.

The fact is, the pot shouldn't have any spray that adds lubrication (which Deoxit does), nor clean it so well it squeaks.
And it may squeek when cleaned using a spray.
They often do.

I prefer a thin, foam swab in alcohol.

Ideally, I'd even use acetone, but foam swabs will usually disintegrate with such a strong solvent. If absolutely necessary, one can also squish a cotton swab with some pliers, then use acetone. Just be careful of leaving cotton fibers.

But what if you don't want or need to open the pot for a cleaning?
Is it still possible to reduce or eliminate modwheel bleedthru?

Yes.

One method is to improve the grounding to the pot.
Remember, wire and connectors introduce resistance.
Instead of relying on the thin wires and connectors the Moog provides, a simple mod is to wire a thicker gauge ground wire directly soldered to the pot, with the other end stretching to the best ground in the synth- the chassis or ground pin on the rectifier board.
Common gauge wires for this would be 14-18.
The heavier, the lower the resistance.

Using this method above will provide the best possible ground available, but this might only lower the bleedthru, not totally eliminate it.
It will also mean that when the mod section is removed for service, that heavy wire must be unsoldered.

Is there a better method?
Yes, and when I explained it to the late Bob Moog, he called me a genius and said he wished he had thought of it!
So what is this genius?

A simple magnet and magnetic reed switch.
Same as used in many entry alarm systems.

Glass reed switches usually short dead near a magnet and are hermetically sealed.
Dust will never affect them.
There's no external contact or friction and nothing to wear out either.

One can also remove their mod section via the standard connector without desoldering an extra wire.
Despite the stock wires being thin, the reed switch achieves such a low ohm reading when closed, it's usually unnecessary to add a heavier ground wire as explained above.

Of course, doing both mods is the best of all worlds, but simply isn't necessary usually.

Best of all, we don't have to open or remove the mod pot and it doesn't care if it doesn't reach 1ohm by itself because when properly aligned, the reed switch will easily provide a lower ohm reading than even the best pot.

To implement, one solders a small glass reed switch directly across the mod wheel wires.
A magnet, small, but powerful is then glued directly to the side of the mod wheel in the proper spot.
I highly suggest a very small magnet made of neodymium.
These are both the strongest of all permanent magnets and easiest to mount on a modwheel.
A simple drop of super glue is all that's needed.
These magnets are easily found and for very little money (often 50 for \$5.00 USD) on Ebay.



Reed switches can be found on Ebay also:



Try searching for "strong magnet" or "reed switch" and you'll likely find pages of both. The shape of the magnet is not as important as the size either. Even the smallest round or rectangular style will do.

One can even get fancy and drill a slight hole and embed the magnet in the side of the wheel, but this is purely for cosmetic purists.

One usually can't see or doesn't notice the magnet at all from the top panel of the mod section. I don't suggest trying this as a first timer anyway.

But the principle here is that when the wheel is fully down, the magnet gets close to the reed switch, closes it's contacts and shorts out the pot.

Voila! Zero ohms or as close to possibly achievable.

Usually much less than 1 ohm too. Better than a stock Mini.

It actually improves the Mini over what Moog provided for originally.

What are the possible problems and caveats here?

Many.

Glass read switches come in several sizes and we need a small one.

Those aren't not so hard to find, but it's **very** easy to break a glass reed switch when bending the leads.

Bending the leads is usually necessary for proper mounting and exact placement.

It's not uncommon for me to break one or two trying, despite using two needle-nose pliers, even rounded ones.

One plier is used to bend a lead and one to relieve any tension from the glass ampule.

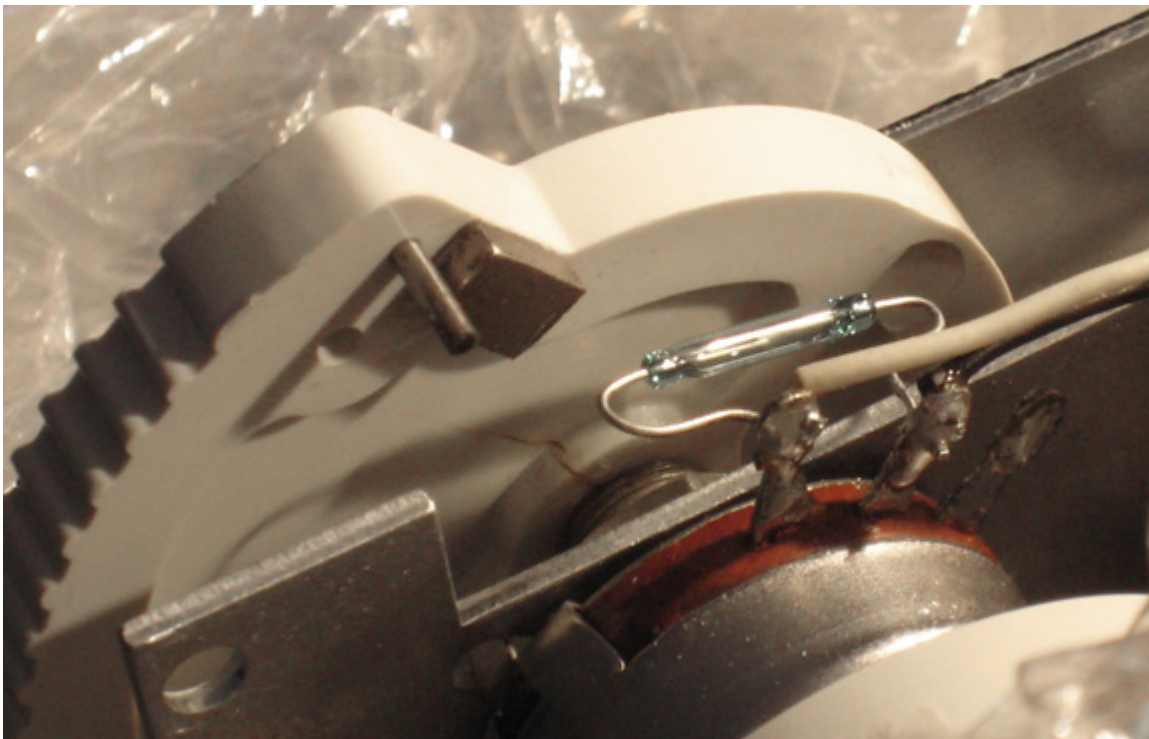
One actually adjusts the exact position for no vibrato by bending the leads and placing the reed switch exactly in the perfect spot for the magnet, which also should be accurately placed.

So, it takes some trial and error (and hopefully before one gets the glue out) to know where to place the magnet and reed switch.

You don't want to short it out too quickly or you'll move the wheel and suddenly the vibrato will come on when the pot is already at, say 100 ohms: far too much for gradual impartation of vibrato.

Here's some pics of the mod below.

Hopefully it will help answer some questions about placement.



One of the tricky concepts to understand here is that the leads of a reed switch are steel too, so the magnet doesn't even need to come close to the center of the reed switch at all, it only needs to get close to a lead of the reed switch.

As shown, this would indicate the far pin of the pot, as shown above.

Again, the magnet only has to come close to this lead, not fully to the center of the reed switch before it closes

the switch.

So align the magnet and reed switch to close under this consideration and not with the assumption it has to actually center up with the glass ampule of the reed switch.

In the photo above, the wheel is fully down, yet you can easily see that the magnet is nowhere close to glass of the reed switch.

Look even closer and you'll notice the contacts in the reed switch are closed in this position.

Properly installed, this mod above can solve modwheel bleedthru in many Minis.

Total cost can be \$10-25 in parts, even with shipping included.